

Operational Modeling and Simulation

Research Areas

- Campaign Planning and Analysis
- Combat Modeling
- Complex Adaptive Systems
- Mobility Modeling
- Support for Air Force Battlelabs
- Support for Air Force Suite of Models (AFSOM)
- Visualization

Recent Findings

Research here includes work with AF/XOC using the AFSOM, the approved collection of models used by the Air Force for analysis of our systems from acquisition to use in combat. Since 1998, our faculty and students have provided over a dozen theses in response to initiatives surfaced from many of the Air Force Battlelabs. These efforts include development of an automated UAV route planning tool written in Java used in Kosovo (see Operational Modeling and Heuristics Modeling). Demonstrated an approach to incorporate currently un-modeled interactions into an existing or a new combat model or simulation. This was accomplished by applying the Leontief Input-Output model, which is a macro-economic model that measures the interactions between major industrial sectors of an economy, as a metamodel that periodically assesses the status of various combat units and support functions. If needed resources are insufficient, appropriate degrades are input into the combat model. As a result, dependencies that are not in the combat model are incorporated. Hence, we can assess the strategic or cascading effects of destroying a set of targets. Faculty member experience in using a variety of combat models as operational analysts in the Air Force and Army, provides expertise to pursue topics with models such as the Attrition Calibration Model (ATCAL) and the Combat Sample Generation Model (COSAGE). The list of modeling and simulation resources that follow illustrate models developed as part of recent student thesis efforts.

Campaign Planning is an intricate, complex endeavor. The ability to model, analyze and evaluate these plans is a critical function for today's (and tomorrow's) OR analysis. On going research in this area is being pursued on a number of fronts that involve other of our major topical areas.

Modeling and Simulation Resources

Aerial Port Operations Model (APOM): The APOM is built in *MODSIM* language. It provides the mobility analyst an animated simulation with two, new measures of aerial port operations; a real-time estimate of airfield capacity subject to changing levels of airfield resources, and an instantaneous count of serviced aircraft (service MOG). Additionally, APOM offers an expanded utility to the mobility analyst by modeling a ground transportation network associated with the aerial port.

Aerospace Ground Equipment (AGE) Utilization Model: The AGE is an analytical model. It is built in the simulation language *AWESIM* and utilizing an Excel interface, this model provides the capability to examine aircraft sortie generation rate impacts due to AGE resources.

Army Recruiting Station Simulation: A policy analysis tool developed for Headquarters, US Army Recruiting Command using the *SIMPROCESS* language in Mar 98. The initial model was developed to examine effects of changes in the amount of time recruiters spend on defined tasks to the number of recruits contracted. The model was enhanced in 1999 to include leadership effects and recruiter personalities. The model was ported to the *AWESIM* language in 2000 with other enhancements (seasonal recruit flows, output on shipping dates as well as contract dates, and others).

B-2 Low Observable (LO) Maintenance Simulation Model: This model was built in *SIMPROCESS*. It evaluates mean LO throughput time, sortie generation rate, proportion of aircraft completing LO maintenance in 0-3, 3-6, and 6-9 days, and the number of mission capable aircraft.

Combat Floys - Prototype model: This model was built in *JAVA*. The combat floys simulation model implements a decision cycle within combatants in a ground engagement. The model provides the capability to examine the impact of decision cycle speed on the ability of a combat unit to demonstrate strategic effects.

Fleet Life Cycle Simulation for the Advanced Medium Range Air-to-Air Missile (AMRAAM): This model was written in *AWESIM*. It models the logistics, flight operations and maintenance actions performed within the system. The simulation models the missile as two sections (guidance and control) to capture failure behavior of the missile at a subsystem level.

Pilot Inventory Complex Adaptive Simulation (PICAS) - Prototype Model: PICAS, built in *JAVA*, uses complex adaptive agent simulation to model pilot retention.

JSF Autonomic Logistics (AL) Model: This model was built in *JAVA* with *SILK* simulation libraries. This is a prototype simulation model laying out the major objects and interactions of the JSF's AL System.

Unmanned Aerial Vehicle (UAV) Mission Level Simulation: This is a prototype model which was built in *JAVA*. This model provides simulation and analysis support to examine the effect of speed, endurance, and weather susceptibility on UAV operational effectiveness.

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C-17 Airdrop Simulation

- **Object-Oriented Simulation**
- **Sponsored by C-17 System Program Office**
- **Used by HQ AMC and XVIII Airborne Corp**

